MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2019/2020

PDS0101 –INTRODUCTION TO DIGITAL SYSTEMS

(All sections / Groups)

23 OCTOBER 2019
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of **13 pages (including this page).**
2. Answer ALL FIVE questions.
3. Please **WRITE ALL YOUR ANSWERS IN THE QUESTION PAPER ITSELF** in the space allocated.

Question 1

(a) Perform the arithmetic operation for the following number systems with steps to show your work.

(i) $569_{16} + 3AF_{16}$

(ii) $612_8 - 56_8$ [2 marks]

(b) John has bought an arduino device with the transmission rate of 25bps. Calculate the time needed to transmit 100kByte of data from the transmitter (the Arduino device) the receiver serially. Follow the below steps.

(i) Identify its period.

(ii) Identify the size of data in bits

(iii) Time needed to serially transfer all data in

- second (s)
- hour (h)

[1+1+1+1 marks]

Continued...

(c) Perform the arithmetics operation of $(-56)_{10} - (-2)_{10}$ in 8-bit binary using the signed-2's complement representation for negative number(s). Show all steps.

[4 marks]

Question 2

(a) Convert the hexadecimal number FFACB01 to the following number systems with steps to show your work.
(i) Decimal
(ii) Binary
(iii) Octal

[1+1+1 marks]

Continued...

(b) Given the Boolean function Y = A'C' + ABC + AC':

(i) Draw the logic diagram of the given function.

(ii) Obtain the truth table of the function.

(iii) Simplify the function to a minimum number of literals using Boolean Algebra.

(iv) Obtain truth table of the function from the simplified expression and show that it is the same as the one in part (iii).

[2+2+1+2 marks]

Continued...

Question 3

(a) Given the function F(A,B), implement it using only NOR gates.

$$F(A,B,C) = (A+B')(A'+B')(B'+C)$$

(i) Obtain the function F(A,B,C) using only NOR gates.

(ii) Draw the logic circuit using only NOR gates as expressed in (i)

[1+2 marks]

Continued...

(b) Given the four inputs (A,B,C,D) and one output (X). Design a combinational logic circuit that shows logic 1 if the Most Significant Bit (MSB) and Least Significant Bit (LSB) of the input combination are the same. The output is logic 0 otherwise.

(i) Obtain its truth table

(ii) Obtain its simplified Boolean function in POS form using K-Map

(iii) Draw the logic circuit based on the simplified Boolean function as in (ii)

(iv) Based on the simplified Boolean function in (ii), represent it using only NOR gates.

[2+2+2+1 marks]

Answer

(i)

A	B	C	D	X

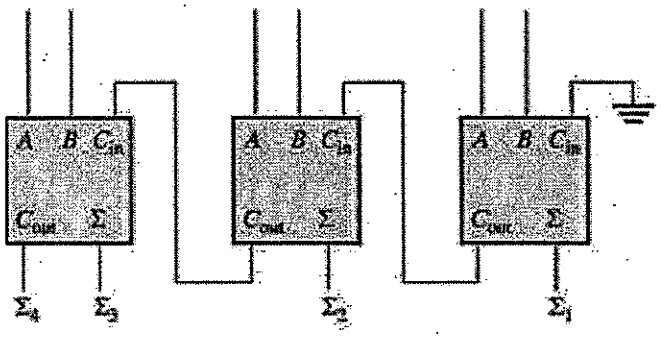
Continued...

Question 4

(a) Based on the block diagram of 3-bit parallel adder by using only full adder. It illustrates how carries are connected between its next pair of bit. Given the input $A = 110_2$ and $B = 011_2$, what are the binary values of the inputs and outputs. Label it in the block diagram.

[3 Marks]

Answer



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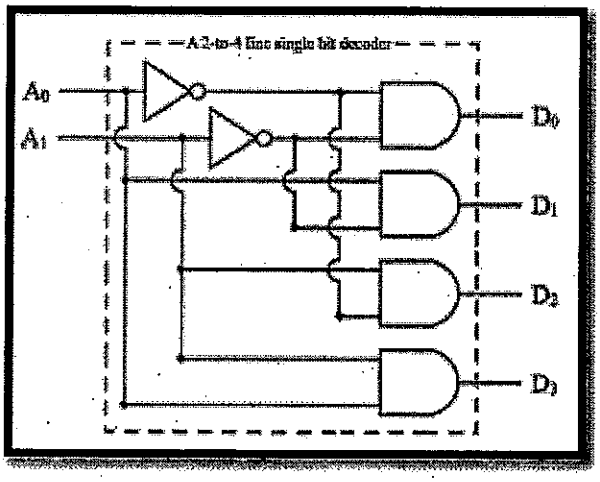
(b) Given the logic diagram of 2-4 line decoder as below.

(i) Determine whether it is active-high or active-low decoder.

(ii) Draw the truth table of the given 2-4 line decoder.

[1+2 marks]



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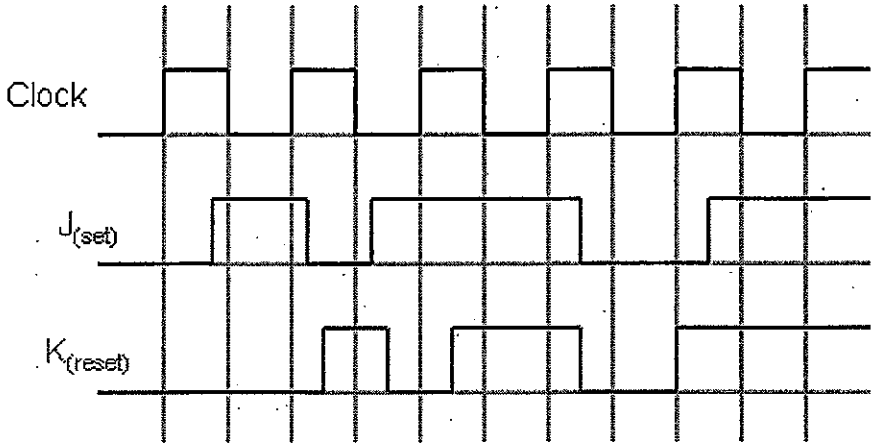
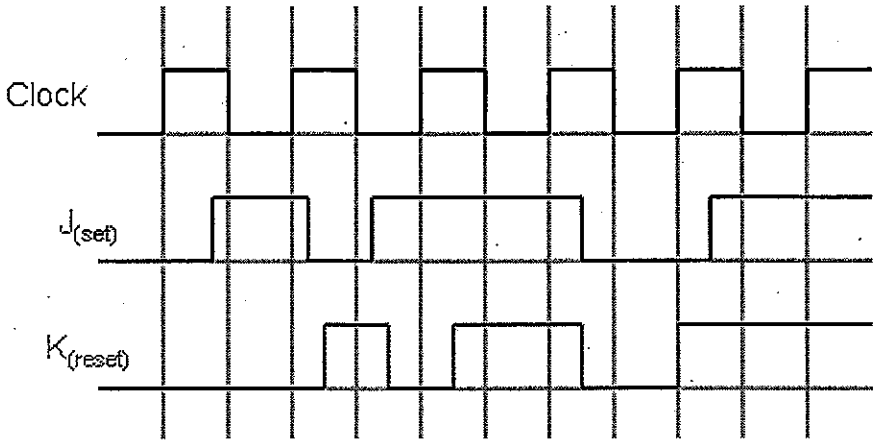
(c) Determine the output Q in relation to negative-going transition clock and its corresponding J-K inputs. Assume the flip-flop is initially RESET. [2 marks]





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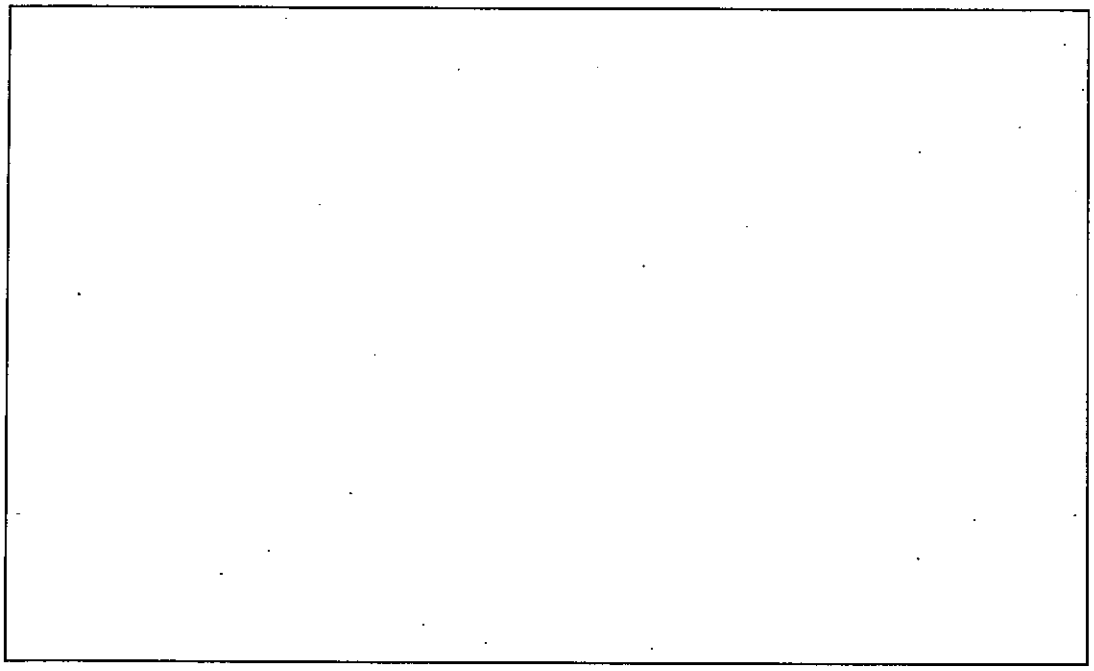
(d) Explain register? Explain why D flip-flops is used in designing register as compared to JK flip-flops. [2 marks]



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Question 5

(a) Design a **3-bit synchronous counter** using **J-K flip-flops** that produce the following sequence: **000, 001, 010, 100, 101, 110** and **repeat**. The undesired states must always go to DON'T CARE on the NEXT clock pulse. Your design should include

(i) State transition diagram showing all possible states,

(ii) Circuit excitation table for J_A, J_B, J_C, K_A, K_B, K_C using Present States and Next States

(iii) Karnaugh Map simplification for each of J_A, J_B, J_C, K_A, K_B, K_C inputs.

(iv) Draw the 3-bit synchronous counter using J-K flip-flops.

[2+2+3+3 marks]

Answer

(i)

(ii)

C	B	A	C_N	B_N	A_N	J_C	K_C	J_B	K_B	J_A	K_A
0	0	0									
0	0	1									
0	1	0									
0	1	1									
1	0	0									
1	0	1									
1	1	0									
1	1	1									

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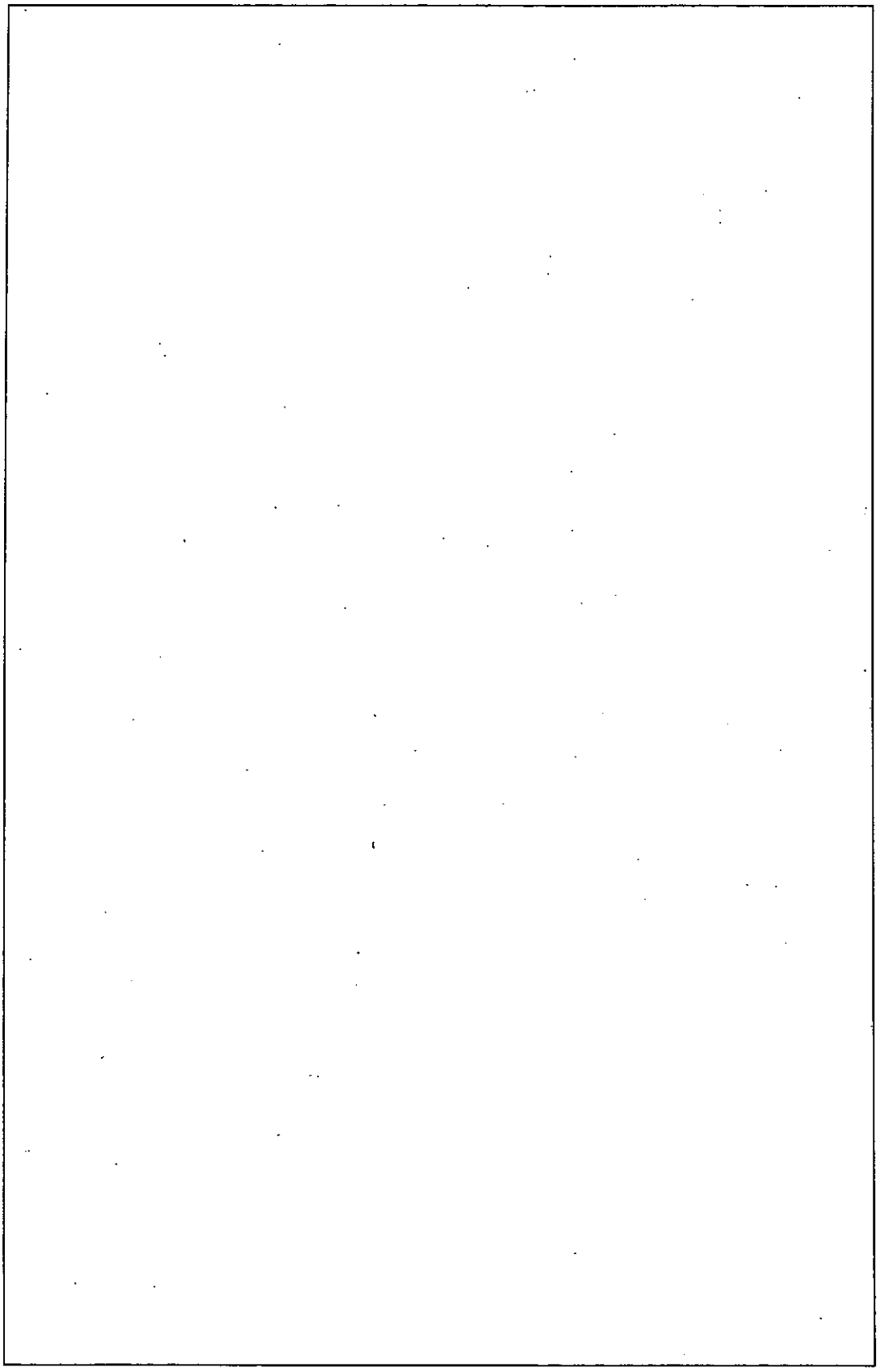

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(vi)

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